

Minimum Flow and Levels for the Loxahatchee River and Estuary

Executive Summary

Chapter 1 – Introduction

This report documents the methods and technical criteria used by staff of the South Florida Water Management District (SFWMD) to develop proposed minimum flows and levels (MFLs) for the Loxahatchee River and estuary. Section 373.042(1) F.S. defines MFLs and directs the SFWMD to use the best available information in establishing a minimum flow or level. Passage of additional MFL legislation in 1997 added the requirements to consider changes and structural alterations, allow exclusions, and require development of a MFL recovery strategy for water bodies that are not expected to meet the proposed criteria.

Water Resource Functions. Each surface water body or aquifer serves an array of functions. Water resource functions protected under Chapter 373 are broad and include flood control, water quality protection, water supply and storage, fish and wildlife protection, navigation and recreation.

Harm Standards. Surface water management and consumptive use permitting regulatory programs must prevent *harm* to the water resource. Hydrologic criteria considered in this evaluation include water flows and levels, duration, duration and in some cases, return frequency components to define the amount of water that can be allocated from the resource. For the purposes of establishing the MFL for the Loxahatchee River and estuary, *significant harm* means the temporary loss of water resource functions which result from a change in surface water or ground water hydrology that take more than two years to recover, but which is considered less severe than serious harm. Water shortage declarations are designed to prevent *serious harm*, interpreted as long-term, irreversible, or permanent impacts, from occurring to water resources.

Chapter 2 – Description of the Water Body

The hydrology of South Florida is strongly affected by its climate and seasonal weather patterns. The Loxahatchee River basin has a subtropical climate and an average rainfall of about 61 inches per year. About 67% of this rainfall occur during the hot and humid wet season (May through October) and the remainder, during the mild dry season (November through April).

The Loxahatchee River System. The Loxahatchee River and estuary is a small (544 M²), shallow, water body located in southeastern Florida that empties into the Atlantic Ocean at the Jupiter inlet. The watershed drains an area of over 200 sq. miles within northern Palm Beach and southern Martin counties. Historically this system was primarily freshwater, however tidal flows opened the inlet for some of the time. In 1947, the inlet was dredged for navigation and has remained permanently open since that time. Drainage patterns within the basin have been significantly altered due to drainage and development, road construction (e.g., Florida Turnpike, BeeLine Highway), and construction of the C-18 canal to provide flood protection for residential areas. The Loxahatchee River basin contains three major tributaries: the Northwest Fork, the North Fork, and the Southwest Fork. These three tributaries drain to the central embayment (estuary) which ultimately discharges to the Atlantic Ocean via the Jupiter inlet.

Northwest Fork. The Northwest Fork of the Loxahatchee River originates in the Loxahatchee Slough, which flows north and bends to the east flowing through Jonathan Dickinson State Park. In 1985, the NW Fork of the river was designated by federal and state government as Florida's first "Wild and Scenic River" and is often referred to as the "last free flowing river in southeast Florida". Portions of the river are also designated as an Aquatic Preserve, Outstanding Florida Water (OFW), and is included as an important component of Florida's state park system.

In the early 1970s, it was recognized that hydrologic alterations of the watershed have reduced the volume of freshwater delivered to the river, resulting in the upstream movement of saltwater during dry periods. The primary problem affecting the ecology of the NW Fork is the gradual reduction in the number and geographic extent of healthy bald cypress communities in the river floodplain and their replacement by saltwater tolerant mangroves. Today, virtually all of the cypress in the lowermost areas of the Wild and Scenic River segment are now dead, and are not reproducing, as are the majority of cypress below Kitching Creek (river mile 8.1). Above Kitching Creek, the number of live cypress trees increases with increasing distance up river. Based on a review of the literature and the results of this study, it is evident that the decline of cypress is linked to the periodic upstream movement of saltwater during dry periods.

Southwest Fork. The Southwest Fork has been heavily altered, dredged and channelized. The Southwest Fork includes the C-18 Canal which is controlled by the S-46 structure, which passes water from C-18 into the Southwest Fork of the Loxahatchee estuary. Water quality and salinity levels in the SW Fork are influenced primarily by saltwater exchange through the inlet except during periods when S-46 discharges of freshwater from C-18. Previous environmental surveys of the area have recorded oyster beds downstream of the structure, however no seagrass beds were found upstream of the mouth of the Southwest Fork.

Although the C-18 canal is not directly used as a potable water source for local utilities, it does provide a recharge function during wet periods. Under high flow conditions, the Town of Jupiter and SeaCoast Utilities have the ability to divert C-18 water to a series of interconnected lakes and canals to provide higher stages to allow for recharge of the surficial aquifer. When canal water levels fall below a specified level, these utilities are no longer allowed to divert water away from C-18 as a matter of their permit conditions.

The Town of Jupiter is one of the state's first large municipalities to use reverse osmosis (RO). This treatment technology converts brackish water obtained from wells drilled 1,500-2,000 ft. deep into the Floridan aquifer to produce a high quality drinking water. Use of water from this source does not deplete water availability in the surficial aquifer or Loxahatchee River system. A waste product of this process is brine, a concentration of salts and minerals. The brine is aerated to remove hydrogen sulfide before it is discharged into a mixing zone downstream of S-46 with final discharge to the Southwest Fork of the estuary as per FDEP requirements. The Town of Jupiter has requested the District to consider establishing a minimum flow for the Southwest Fork to provide for dilution of the brine effluent to avoid potential water quality problems at the point of discharge.

Chapter 3- Methods

Minimum flow criteria for the NW Fork of the Loxahatchee River were based on a review of the following information: (1) Development of a "Valued Ecosystem Component" (VEC) approach for establishing the minimum flow based on cypress forest/mangrove distributions, (2) review of the available literature, (3) analysis and interpretation of historical and present day aerial photography to document changes in river vegetation over time, (4) Results from a recent vegetation survey of the NW Fork of the river, (5) statistical analysis and interpretation of flow and salinity data collected from the river from 1994-2000, and (6) development and application of an estuarine hydrodynamic-salinity model to explore the relationship between freshwater flows and salinity within the river and estuary.

Minimum flow criteria for the Southwest Fork of the Loxahatchee estuary were based on a review of available hydrologic, water quality and biological data collected from literature sources; flood control and water supply needs within the basin; wildlife usage of the downstream estuary; and discussions with FDEP regulatory staff. This information was reviewed and balanced against the need to provide a minimum flow for the S-46 structure to allow for the dilution of brine effluent at the point of discharge.

Chapter 4- Water Resource Functions and Considerations

The Loxahatchee River watershed provides a wide range of functions and services to the regional system. The primary water resource functions considered in the development of MFLs for the NW Fork of the river

included: (a) protection of fish and wildlife habitat, (b) preservation of the river's wild and scenic values, (c) providing drainage and flood protection for surrounding areas, (d) water supply, (e) recreation and navigation, (f) preservation of historical and archeological values, and (g) water quality improvement. In addition, a number of features and functions were considered in the development of the MFL. These considerations included: alteration of natural systems, hydrologic changes to the basin, potential impacts to water supply, the need for flood protection and water quality improvement, and the river's use for navigation and recreation.

Chapter 5- Proposed Criteria

MFL technical criteria for the NW Fork and SW Forks of the Loxahatchee River and estuary were defined based on the functions provided by the resource and the technical relationships established among flow, salinity and impacts to biological resources along the river corridor.

NW Fork of the Loxahatchee River. The significant harm criteria developed for the NW Fork of the river were based on the relationship between river flow and salinity and protection of remaining cypress habitat against significant harm (i.e., minimizing the impacts of saltwater intrusion during the dry season).

Proposed MFL Criteria – *Surface water flows delivered to the NW Fork of the Loxahatchee River from the Lainhart Dam during dry periods shall not fall below 70 cfs for more than 20 days duration unless monitoring of the salinity wedge (defined by a river bottom salinity concentration of 2 ppt) documents that inflows from other tributaries are sufficient to maintain the salinity wedge at or downstream of river mile 8.1*

In consideration of the proposed MFL, it is recognized that the Loxahatchee Slough and Lainhart Dam cannot alone provide sufficient water to meet the MFL on a continuous basis. The other three tributaries (Cypress Creek, Hobe Grove Ditch and Kitching Creek) must provide a portion of this flow. Additional monitoring is needed to provide a better estimate of the amount of water contributed by these ungauged tributaries

SW Fork of the Loxahatchee Estuary. The significant harm criteria developed for the SW Fork of the Loxahatchee estuary was based on the need to avoid potential water quality problems at the point of discharge (downstream of S-46) for the discharge of brine effluent resulting from the operation of the Town of Jupiter's reverse osmosis plant.

Proposed MFL Criteria - *During dry periods, when the Town of Jupiter's reverse osmosis water treatment plant is in operation, a constant minimum flow of 5 cfs through the S-46 structure is recommended to reduce the problems of hypersaline conditions, toxicity or ion imbalance that may result from the discharge of brine effluent downstream of S-46.*

MFL Research – Additional research is recommended to refine and or validate the proposed MFL criteria and/or technical relationships identified above. A number of projects are proposed to address these issues.

MFL Recovery and Prevention Plan – And finally, a phased MFL Recovery plan is discussed to reconnect the Loxahatchee watershed with the regional water system to provide additional water to meet the proposed MFL by 2020.